

Recovery Strategy for the Greater Sage-Grouse *phaios* subspecies (*Centrocercus urophasianus phaios*) in Canada

Greater Sage-Grouse *phaios* subspecies



2017



Recommended citation:

Environment and Climate Change Canada. 2017. Recovery Strategy for the Greater Sage-Grouse *phaios* subspecies (*Centrocercus urophasianus phaios*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. vii + 19 pp.

For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](http://sararegistry.gc.ca)¹.

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Également disponible en français sous le titre
« Programme de rétablissement du Tétrás des armoises de la sous-espèce *phaios*
(*Centrocercus urophasianus phaios*) au Canada [Proposition] »

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ISBN

Catalogue no.

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¹ <http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1>

Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)² agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change is the competent minister under SARA for the Greater Sage-Grouse *phaios* and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Province of British Columbia, as per section 39(1) of SARA.

The recovery of the Greater Sage-Grouse *phaios* in Canada is not considered to be technically or biologically feasible. The species may, however, benefit from general conservation programs in the same geographic area and will receive protection through SARA and other federal, and provincial or territorial, legislation, policies, and programs.

The feasibility determination will be re-evaluated as part of the report on implementation of the recovery strategy, or as warranted in response to changing conditions and/or knowledge.

The recovery strategy sets the strategic direction to support recovery of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area³ be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

² <http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2>

³ These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Bird Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

Acknowledgments

This document was developed by Darcy Henderson, Matt Huntley, and Kella Sadler (Environment and Climate Change Canada, Canadian Wildlife Service – Pacific region (ECCC CWS-PAC)). Due to the lack of adequate information for the Greater Sage-Grouse *phaios* much of the species information is based on the Amended Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada (Environment Canada 2014) prepared by Troy I. Wellicome and Joy Stevens. Valuable review and comments were provided by Marie-Andrée Carrière (ECCC CWS-National Capital Region) and Orville Dyer and Myke Chutter (B.C. Ministry of Environment).

Executive Summary

The Greater Sage-Grouse (*Centrocercus urophasianus*) is a turkey-sized, ground-dwelling bird that inhabits temperate, semi-arid sagebrush (*Artemisia* spp.) steppe in Canada and the United States. These birds depend upon sagebrush as a source of food, particularly in winter, and as cover for nesting and avoiding predators. In spring, Greater Sage-Grouse congregate at the same location each year (known as leks) where males perform elaborate dancing displays to attract mates. In Canada two subspecies of Greater Sage-Grouse are recognized, with *C. u. urophasianus* in Alberta and Saskatchewan, and *C. u. phaios* in British Columbia. This recovery strategy applies only to the latter, the Greater Sage-Grouse *phaios* subspecies.

The Greater Sage-Grouse *phaios* was designated as Extirpated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1997 and was subsequently listed as Extirpated in Canada on Schedule 1 of the federal *Species at Risk Act* as of 2003. The only Canadian distribution of this subspecies was the extreme southern end of the Okanagan and Similkameen valleys in south-central British Columbia. The last naturally occurring record of Greater Sage-Grouse *phaios* was 1918 near the community of Oliver, British Columbia. Reintroduction efforts in the late 1950s were unsuccessful. The British Columbia Conservation Data Centre ranks Greater Sage-Grouse SX (extirpated), and the species is protected from capture and killing under the B.C. *Wildlife Act*.

In the United States the Greater Sage-Grouse is not listed under the Endangered Species Act, but in Washington State the species is threatened and protected under State laws. Threats to Greater Sage-Grouse *phaios* in adjacent Washington State are primarily habitat loss and degradation. Irreversible loss of habitat was due to conversion for crop production and urban development. Habitat degradation has been due to livestock grazing, cheatgrass (*Bromus tectorum*) invasion, conifer encroachment, and increasing fire frequency in sagebrush. Increasing populations of native predators, and additive mortality from road collisions and West Nile virus are additional threats to populations. Washington State is using translocations from Nevada and Oregon to try and sustain a remnant viable population, just 100 km south of the British Columbia border. Threats in British Columbia were likely similar to those in Washington State.

Recovery in Canada is not considered biologically and technically feasible at this time. There is insufficient quantity and unsuitable quality of habitat in Canada, very low likelihood of restoring brood-rearing habitat in Canada, and very low likelihood of agreement with the United States to supply birds for translocation into these sub-optimal conditions and contrary to their existing priorities under the Sage Grouse Initiative. Recovery feasibility may be revisited if relict populations are discovered.

Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, recovery of the Greater Sage-Grouse *phaios* in Canada has been determined not to be biologically or technically feasible at this time. Recovery is considered not feasible when the answer to any of the following questions is “no”. The feasibility of recovery may be revised if relict population(s) are discovered in Canada, or if translocation from U.S. populations becomes appropriate.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

No. There are no known individuals of the *phaios* designatable unit capable of reproduction in Canada, because the subspecies was extirpated from its only known range in B.C. nearly 100 years ago. There are individuals capable of reproduction 100 km away and directly south in Washington State. This nearby population is at low numbers (~1000 individuals), hunting was banned in 1988, the species was legally protected in 1998, and the current population is sustained by translocations from Oregon and Nevada where birds are still legally hunted (Stinson et al. 2004). There are individuals of the *urophasianus* designatable unit in Alberta and Saskatchewan, but this critically endangered population could not sustain being used as a source of birds for translocation to British Columbia. Montana populations are contiguous with Alberta and Saskatchewan, and Montana still permits a legal hunting season. Montana has permitted Alberta to capture and translocate birds, consistent with the Western Association of Fish and Wildlife Agencies, Greater Sage-Grouse conservation strategy (Stiver et al. 2006). Conversely, Stiver et al. (2006) and the U.S. Sage Grouse Initiative (NRCS 2015) do not recognize British Columbia as part of the Columbia management zone, nor is there a priority area for conservation within 100 km of British Columbia. Washington State estimates 3,200 birds are a minimum viable population and requires a minimum critical area between 240 to 10,000 km² depending upon habitat quality (Stinson et al. 2004). Without a captive breeding program or the prospect of translocating large numbers of birds, and adjacent efforts immediately across the border in Washington state, there is no likelihood that birds would be available now, nor in the foreseeable 5 to 10 years to restore and sustain the population.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

No. In Washington State they estimate 240 to 10,000 km² is the minimum critical area necessary to support 3,200 Greater Sage-Grouse, depending upon habitat quality. In British Columbia, there is 85.3 km² of sagebrush steppe habitat remaining in the south Okanagan and Similkameen valleys (Iverson et al. 2008), not all of which overlaps with the historic range of the birds. Further, broods depend upon moist valley bottom grasslands and wetlands for early survival (Crawford et al. 2004, Blomberg et al. 2014), but 41% to 92% of those habitats have been lost (Lea 2008).

As for quality of the habitat, in British Columbia most sagebrush historically and currently occupies discontinuous and narrow strips on either side of the floodplains in the Okanagan and Similkameen valleys (Iverson et al. 2008). This configuration of habitat may not have sustained viable populations that require large contiguous areas (Stinson et al. 2004), far from rough terrain or steep slopes (Fedy et al. 2014, Doherty et al. 2008), and far from tree cover (Doherty et al. 2016). Most of the valley floodplain has now been converted to intensively-managed agriculture and urban residential uses (Lea 2008). It is therefore unlikely British Columbia could sustain a breeding population independent from a continuous and larger population of breeding birds in Washington State; either historically or currently.

It is not clear if unregulated hunting or habitat loss caused Greater Sage-Grouse *phaios* extirpation from British Columbia in the early 1900s. Habitat loss is the main factor for decline in Washington State and continues to prevent recolonization after decades of legal protection from hunting in British Columbia and Washington State. There is no reasonable opportunity to restore habitats in the short-term, because intensive agricultural and urban residential land developments in the floodplain are irreversible. Future climate change predictions forecast an expansion of grasslands up-slope into adjacent forests (Wang et al. 2012, Hamman and Wang 2006). However, that expansion is likely to be accompanied by higher fire frequency, further spread of cheatgrass, and failure to produce more sagebrush and perennial grass habitat in valley bottoms most limiting to Greater Sage-Grouse *phaios* in British Columbia.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Unknown. Assuming threats were and continue to be similar as adjacent Washington State, the major threat is loss of habitat (Stinson et al. 2004). This loss historically resulted from conversion for annual crop production, and currently results from incompatible rangeland management practices (clearing sagebrush, over use by livestock), and increased fire frequency following cheatgrass (*Bromus tectorum*) invasion. Conifer encroachment also contributes to habitat loss because Greater Sage-Grouse avoid trees or change their behavior and vulnerability to predation in proximity to trees (Baruch-Mordo et al. 2013; Prochazka et al. 2016). After habitat loss on the order of 75-90% in Washington State, the range of this bird contracted (Stinson et al. 2004) and likely caused extirpation of Greater Sage-Grouse *phaios* from British Columbia. Further habitat loss in British Columbia to residential or cropland conversion, or incompatible range management practices is minimized by large protected areas managed by the Province, Nature Conservancy of Canada, and The Nature Trust of British Columbia. However the brood-rearing habitat of valley-bottom grasslands is irreversibly reduced as a result of intensive agriculture and residential development; thus protection of other habitats may be insufficient to support the life cycle and sustain a population.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

No. Translocations were attempted in the 1950s and failed. Translocation continues to be a high-risk and inappropriate technique owing to the lack of individuals, and information on specific habitat requirements and current threats in Canada. As a result, no population and distribution objectives are identified in this document. A conservation approach has been adopted to support any future dispersal or relict population that may be discovered. Recovery efforts for the *phaios* are ongoing in Washington State, and for Greater Sage-Grouse *urophasianus* in Alberta and Saskatchewan, providing some framework for possible recovery of the Greater Sage-Grouse *phaios* should a relict population be discovered in British Columbia.

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1. COSEWIC* Species Assessment Information

Date of Assessment – April 2008

Common name (population): Greater Sage-Grouse *phaios* subspecies – British Columbia population

Scientific name: *Centrocercus urophasianus phaios*

COSEWIC Status: Extirpated

Reason for designation:

This subspecies has not been seen in its former range in the Okanagan Valley of British Columbia for about a century.

Canadian Occurrence: Formerly British Columbia

COSEWIC Status history:

Has not been reported since the 1960s. Designated Extirpated in April 1997. Status re-examined and confirmed in May 2000 and April 2008. Last assessment based on an update status report.

* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

Note that the subspecies has not naturally occurred in the former range since 1918, and an attempted reintroduction in 1958 was unsuccessful. This accounts for why the species has not been reported since the 1960s in the statement above.

2. Species Status Information

Legal Status: SARA Schedule 1 (Extirpated) (2003).

Table 1. Conservation Status Greater Sage-Grouse *phaios* (NatureServe 2015; B.C. Conservation Data Center 2015; B.C. Conservation Framework 2015).

Global (G) Rank ^a	National (N) Rank ^a	Sub-national (S) Rank ^a	COSEWIC Designation	B.C. List	B.C. Conservation Framework
G3G4T 3Q	Canada (N1) ^b ; United States (N3)	Canada: British Columbia (SX); United States: Oregon (S3), Washington (S1)	Extirpated (2008)	Red	Highest priority: 6 under goal 1,2,3 ^c

^a The conservation status of a species is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, N = National, and S = Subnational). The numbers have the following meaning: 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, 5 = secure. SX = Presumed Extirpated, SNR = Unranked. Additional rank information includes Q = questionable taxonomic validity and T = status of infraspecific taxa (i.e. the *phaios* subspecies).

^b The sub-species *phaios* is not ranked separately from subspecies *urophasianus* at the National level, so the N1 ranking reflects the two combined despite the long-term extirpation of subspecies *phaios* from Canada. Only states with the subspecies *phaios* have S ranks reported here.

^c The three goals of the B.C. Conservation Framework are: 1. Contribute to global efforts for species and ecosystem conservation; 2. Prevent species and ecosystems from becoming at risk; 3. Maintain the diversity of native species and ecosystems

3. Species Information

As per COSEWIC (2008), this recovery strategy separates the Greater Sage-Grouse (*Centrocercus urophasianus*) into the eastern (*C. u. urophasianus*) and western (*C. u. phaios*). Recent genetic evidence does not support delineation of Greater Sage-Grouse into these subspecies (Benedict et al. 2003; Oyler-McCance et al. 2005). However, in Canada COSEWIC still considers the two subspecies designatable units with geographically discrete breeding populations and in two significantly different ecological areas (see Figure 1). The subspecies *phaios* historically occupied grazing-sensitive vegetation dominated by the evergreen basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and bluebunch wheatgrass (*Pseudoregneria spicata*) in the Southern Mountain Ecological Area of British Columbia. Meanwhile, the subspecies *urophasianus* occupies grazing-resilient vegetation dominated by mixedgrass prairie with the deciduous silver sagebrush (*Artemisia cana*) in the Prairie Ecological Area of southeastern Alberta and southwestern Saskatchewan.

The Greater Sage-Grouse *phaios* was formerly a range extension of the Columbia Basin Distinct Population Segment (DPS) that is currently critically imperiled in Washington State (USFWS 2003).

3.1 Species Description

Greater Sage-Grouse are ground-dwelling birds and the largest species of grouse in North America. They have brownish-grey upperparts with a blackish belly, the undersides of the rounded-wings are whitish and its long black-and-white tail has distinctive tips. Adult males have a white band on a black throat and a large ruff of pointed white feathers concealing the yellowish air sacs that inflate during courtship displays. Other male characteristics include fleshy yellow combs above the eyes and long, hairlike feathers arising from the nape. Both sexes have a diagnostic black patch on the belly (it is larger on the male). The female has more cryptic plumage and an inconspicuous comb above the eye and is smaller than the male, which can reach 75 cm in length.

Greater Sage-Grouse are polygynous, as individual males typically mate with several females. Males perform ritualistic displays, called strutting, on communal leks⁴ to attract females, who select a male from the group with which to mate (Bergerud 1988;

⁴ Leks are open areas where male and female Sage-Grouse aggregate, males engage in competitive displays, and mating occurs (Connelly et al. 2000; Walsh et al. 2010).

Connelly et al. 2004). Males begin displaying at leks in early spring, and strutting commences before sunrise each morning and continues until about a half-hour after sunrise (Jenni and Hartzler 1978; Aldridge 2000).

3.2 Species Population and Distribution

Greater Sage-Grouse require sagebrush (*Artemisia* spp.) and are year-round residents in the sagebrush-grasslands of the semi-arid mixed-grass prairie of southeastern Alberta and southwestern Saskatchewan, and formerly of the semi-arid bunchgrass biogeoclimatic zone in southcentral British Columbia. This Canadian distribution is the northern limit of the Greater Sage-Grouse range in North America (Aldridge 1998; Braun 1998; Connelly et al. 2000; Connelly et al. 2004).

By the year 2000, the range of Greater Sage-Grouse in North America had been reduced to half its historical range (668 412 km², down from 1 200 483 km²; Schroeder et al. 2004), now occurring in eleven states and the provinces of Alberta and Saskatchewan (Figure 1) (Aldridge and Brigham 2003). The current Greater Sage-Grouse range in Canada (~7370 km²; Figure 1) occupies about 7% of the historical Canadian range (~100 000 km²), and now only includes the *urophasianus* owing to extirpation of the *phaios* from British Columbia (Aldridge 2000; Aldridge and Brigham 2003). In Washington State, Greater Sage-Grouse *phaios* only occupy 8% of their former range (Stinson et al. 2004).

The area historically occupied by Greater Sage-Grouse *phaios* in Canada is approximately 200 km² at the extreme northern extent of its range, and at the extreme southern end of two deep and narrow valleys, the Okanagan and Similkameen, that open to a broader plain southward into Washington State (Cannings et al. 1987). The big sagebrush on which Greater Sage-Grouse *phaios* depend is limited to lower elevation grasslands within the Bunchgrass and Ponderosa Pine biogeoclimatic zones (Meidinger and Pojar 1991).

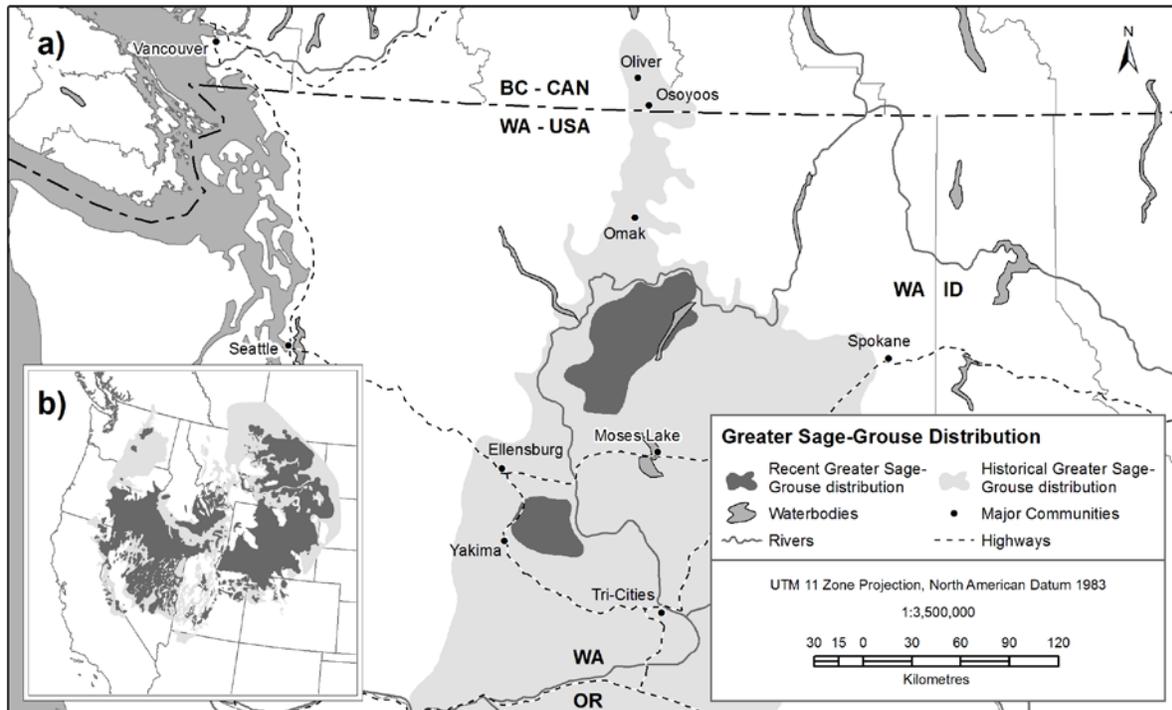


Figure 1. Estimated historical and known recent Greater Sage-Grouse distribution in, a) British Columbia and adjacent Washington State, and b) range-wide in North America (data from Connelly et al. 2004)

In Canada, the Greater Sage-Grouse *phaios* was historically at the periphery of its North American range (Figure 1). Infrequent occurrences in the south Okanagan Valley were documented from 1864 to 1918 and during this period there is no documented reference of Greater Sage-Grouse *phaios* breeding. The last naturally occurring Greater Sage-Grouse *phaios* in British Columbia was shot in 1918 (Cannings et al. 1987). In 1958, 57 birds from Oregon were translocated to British Columbia near Richter Lake, 10 km west of Osoyoos and between the Okanagan and Similkameen valleys (Campbell and Ryder 2010). Most did not survive the winter or crossed the border into Washington, but two independent breeding records were documented in May and July of the following year near Kilpoola Lake, 5 km west of Osoyoos and 5 km southeast of the release site (Campbell and Ryder 2010). Four post-translocation records of Greater Sage-Grouse observations were recorded between 1962 and 1966 including the last report of Greater Sage-Grouse in British Columbia, of a dead bird observed August 14, 1966 on the “Osoyoos side of Anarchist Mtn” (Barkley 1966 as cited in Campbell and Ryder 2010) perhaps 15 km east of the original release site. Greater Sage-Grouse *phaios* has not been recorded in Canada in 50 years and was designated as Extirpated by COSEWIC in 1997 (Hyslop 1998).

3.3 Needs of the Greater Sage-Grouse *phaios*

Greater Sage-Grouse have specific habitat requirements for mating, nesting, brood-rearing, and wintering that appear consistent across their range (see Habitat

reviews in Aldridge 2000; Connelly et al. 2004; Connelly et al. 2011). For that reason, reference to research throughout the range of Greater Sage-Grouse should reasonably apply to the extirpated Greater Sage-Grouse *phaios* in British Columbia.

Generally, sagebrush is important for both cover and food (Patterson 1952; Braun et al. 1977; Connelly et al. 2000; Connelly et al. 2004), with leaves comprising <60% of Greater Sage-Grouse summer diet but virtually 100% of their winter diet (Patterson 1952; Wallestad et al. 1975; Hanf et al. 1994; Connelly et al. 2004). Broadleaf non-woody plants (forbs) and insects are dietary requirements during all seasons except winter (Wallestad et al. 1975; Drut et al. 1994a and 1994b). Forbs are a rich source of protein and provide habitat that enhances the availability of insects (Huer 2004), which in turn can influence nest initiation, clutch size, and reproductive success (Barnett and Crawford 1994; Coggins 1998; Connelly et al. 2004), including growth and survival of the chicks (see summary in Lungle and Pruss 2008).

In Washington State, Greater Sage-Grouse *phaios* populations occur on low-relief topography with slopes <16°, with 10-35% canopy cover of sagebrush interspersed with rabbitbrush (*Ericameria nauseosus*) and antelope bitterbush (*Purshia tridentata*), a dense understory of native bluebunch wheatgrass and Idaho fescue (*Festuca idahoensis*), and few or no trees (Stinson et al. 2004). Research throughout the range of Greater Sage-Grouse indicates sagebrush density at northern peripheries of their range is near or below the threshold required further south (Doherty et al. 2016). Further, Greater Sage-Grouse are known to remain in proximity to riparian areas (Blomberg et al. 2014), and avoid croplands, grasslands without sagebrush, trees, rough terrain and steep slopes (Patterson 1952, Fedy et al. 2014, Doherty et al. 2008, Doherty et al. 2016). In British Columbia, suitable habitat occurred in narrow strips along valley bottoms of the south Similkameen and Okanagan valleys. It is likely the steep rocky slopes of the valleys and increasing tree cover with elevation limited habitat availability. In comparison, the Okanagan valley immediately south of the Canadian border is broader, gentler in topography, and has fewer trees.

In spring, Greater Sage-Grouse congregate at leks upon which male birds dance and female birds select mates. Leks vary in area from 0.04–16 ha (Scott 1942; Patterson 1952; Dalke et al. 1963; Parks Canada Agency 2009), and can occur on natural or anthropogenically disturbed locations (Stinson et al. 2004). Most leks have a central area of matted grass and bare ground free of shrubs, to improve visibility of the display and for predator vigilance. Males will occupy surrounding stands of dense sagebrush for feeding and roosting during the mating season.

Greater Sage-Grouse nesting habitat is typically a broad area of sagebrush and grassland surrounding leks (Aldridge 2000). Nests are on the ground, usually under the canopy of a sagebrush, and surrounded by tall grass cover to help conceal nests from mammalian and avian predators (DeLong et al. 1995; Connelly et al. 2011).

In summer, Greater Sage-Grouse brood-rearing habitat changes over time (Stinson et al. 2004). Initially the brood remains close to the nest site to forage. As the

dry heat of summer cures the upland vegetation, broods move to progressively moister meadows in search of insects and green and moisture-rich forbs on which to feed (Crawford et al. 2004). Foraging occurs in patches of low sagebrush cover and high ratios of forbs to grasses, whereas roosting and loafing occurs in adjacent dense patches of sagebrush. Males remain in upland sagebrush cover throughout the summer (Hagen 1999). Hens and broods move into dense sagebrush in late-summer and fall before moving to wintering grounds (Patterson 1952; Wallestad 1971; Drut et al. 1994a).

In winter, Greater Sage-Grouse usually congregate in sexually-segregated flocks (Beck 1977; Eng and Schladweiler 1972; Connelly et al. 1988). Winter survival of Greater Sage-Grouse is typically high (Connelly et al. 2004; Aldridge et al 2004). For food and shelter during winter, Greater Sage-Grouse rely almost exclusively on taller sagebrush exposed above snow (Tack 2009; Connelly et al. 2011), and they will move long distances to avoid deep snow and seek out dense sagebrush for thermal cover in severe weather (Moynahan et al. 2006). On a local scale, Greater Sage-Grouse usually select low elevation, south- or southwest-facing slopes with tall and dense sagebrush (see detailed review in Connelly et al. 2011). Ideal winter habitats were likely very limiting in British Columbia compared to southward in Washington State.

4. Threats

4.1 Threat Assessment

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (Salafsky et al. 2008). Threats presented here do not include biological features of the species or population which are considered limiting factors.

The threat classification used in this document is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre and the B.C. Conservation Framework. For a detailed description of the threat classification system, see the Conservation Measures Partnership website (CMP 2010).

A threat assessment was not completed for the Greater Sage-Grouse *phaeos* as no extant locations in Canada are known. As no locations are known, threats cannot be scored for scope⁵ or severity⁶ to determine individual threat impacts⁷ nor is it possible to calculate the overall threat Impact⁸ for this species at this time. Instead, threats were examined and described using the IUCN-CMP threat categories.

4.2 Description of Threats

Possible threats to Greater Sage-Grouse *phaeos* in Canada are discussed below under the Threat Level 1 headings (Threat Level 2 headings provided in brackets). Some of these threats (particularly habitat loss, livestock grazing, and West Nile virus) may be ongoing should a relict population be discovered in Canada or if reintroduced populations were established in the future.

IUCN-CMP Threat 1 – Residential & commercial development [1.1 Housing & urban areas; 1.2 Commercial & industrial areas]

Habitat loss and degradation due to urban and commercial developments were likely significant threats to Greater Sage-Grouse *phaeos* in Canada. It is likely the development of Osoyoos and Oliver in valley bottoms (see Lea 2008) interfered with movements of individuals historically. Now the footprint of those communities is growing to span the full width of the Okanagan valley, effectively fragmenting the available habitat. Anthropogenic areas are believed to contribute to cumulative landscape effects that suppress populations (Braun et al. 2002; Naugle et al. 2011). It is unclear whether year-round avoidance of anthropogenic sites is primarily due to noise or to other influences, such as associated habitat conversion or elevated vehicle traffic at such sites (Environment Canada 2014).

⁵ **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%)

⁶ **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%)

⁷ **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: very high (75% declines), high (40%), medium (15%), and low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

⁸ The overall threat impact is calculated following Master et al. (2009) using the number of Level 1 Threats assigned to this species. The overall threat considers the cumulative impacts of multiple threats.

IUCN-CMP Threat 2 – Agriculture and aquaculture [2.1 Annual & perennial non-timber crops; 2.3 Livestock farming & ranching]

Habitat loss due to conversion of native vegetation to irrigated croplands was likely a significant historical threat. Although much of the upland sagebrush on sloped alluvial fans and glacio-lacustrine benches remain in British Columbia, the brood-rearing habitat of moister valley bottom grasslands has all but been eliminated in the Okanagan valley (Lea 2008, Bezener et al. 2006)). Although the rate of conversion has slowed because much of the arable land is already under cultivation, this threat does continue and is unlikely to be reversed.

Habitat degradation due to certain livestock grazing practices is recognized as a historical, current, and future threat throughout the Greater Sage-Grouse range in Canada and the United States (see review in Environment Canada 2014). High stocking-rates can adversely impact habitat by decreasing vegetation height for nesting cover, and decreasing forb and insect biomass upon which broods forage (Beck and Mitchell 2000). Grazing has also been shown to increase the probability of invasion by the invasive annual cheatgrass (Reisner et al. 2013), with consequences for fire frequency and sagebrush habitat loss (see Threat 7 below for additional information).

IUCN-CMP Threat 4 - Transportation & service corridors [4.1 Roads & railroads]

Direct impacts from roads on Greater Sage-Grouse may include direct habitat loss from road construction, direct mortality due to roadkill, fragmenting potential habitat, and facilitating the movement of predators and the spread of invasive exotic plant species (Aldridge 1998; Braun 1998). Indirect influences such as noise and motion from vehicles can disrupt local breeding activities and Greater Sage-Grouse tend to avoid these areas (Braun 1998). A major Provincial highway #97, and National highway #3, with associated high traffic volumes, bisect the historic range of Greater Sage-Grouse in British Columbia.

IUCN-CMP Threat 7 - Natural system modifications [7.1 Fire & fire suppression; 7.3 Other ecosystem modifications]

Fire is a significant threat to recovery efforts in the Columbia Basin population in central Washington (Stinson 2014), which is the closest analogue to the extirpated British Columbia population. Basin big sagebrush can take decades to centuries for cover and density to fully recover following fires (Baker 2011). Following fires, Greater Sage-Grouse are slow to recolonize burned areas even if structural features of the shrub community have recovered (Connelly et al. 2011). Fire is a natural disturbance in sagebrush steppe, and historically Greater Sage-Grouse could simply move to more suitable unburned habitat. Currently, the population and habitat has been reduced and fragmented such that a fire in an isolated fragment could further reduce the population and distribution. Fire frequency has also increased over time in habitats further south in Washington (Stinson 2014), but not yet in British Columbia.

Conversely, after a century of successful fire suppression coniferous trees have expanded from higher elevations into lower elevation grasslands and sagebrush steppe in British Columbia (Bai et al. 2005; Gyug and Martens 2002; Turner and Krannitz 2000). Conifer encroachment also contributes to Greater Sage-Grouse habitat loss independently of the other factors, as proximity to trees negatively affects Greater Sage-Grouse behavior and vulnerability to predation (Baruch-Mordo et al. 2013; Prochazka et al. 2016; see Threat 8 below for more information).

Another complex natural system modification on-going and increasing in future, involves the invasion of cheatgrass facilitated by livestock grazing (Reisner et al. 2013), which then increases fuel loads and the frequency of fire (Baker 2011), which reduces sagebrush habitat for Greater Sage-Grouse (West and Yorks 2002; Connelly et al. 2004). Ironically though, after cheatgrass invasion has occurred, livestock grazing is one of the few tools available to reduce fuel-loads and the risk of wildfire while also protecting adjacent sagebrush habitat (Reisner et al. 2013). This natural system modification appears to be irreversible in the foreseeable future.

IUCN-CMP Threat 8 - Invasive & other problematic species & genes [8.1 Invasive non-native/alien species; 8.2 Problematic native species]

Invasion by non-native exotic plant species has changed the composition of sagebrush communities in the Okanagan Valley and across western North America. Replacement of native perennial bunchgrasses by cheatgrass has been shown to negatively correlate with habitat selection by Greater Sage-Grouse (Kirol et al. 2012). Invasion by cheatgrass has also resulted in dramatic increases in the number and frequency of fires that results in replacement of sagebrush by annual species, which provides little habitat value for Greater Sage-Grouse (Baker 2011; Condon et al. 2011). Cheatgrass is widespread in the Bunchgrass biogeoclimatic zone of British Columbia, and appears more common where soil disturbance has occurred in the past.

West Nile virus (WNV) is a current and future threat to Greater Sage-Grouse populations throughout North America. WNV was introduced into North America in 1999 (Reisen 2013) and was first documented in Greater Sage-Grouse in 2002 (Walker and Naugle 2011). Greater Sage-Grouse are highly susceptible to WNV and suffer high rates of mortality (Clark et al. 2006; McLean 2006). The primary vector of WNV in sagebrush ecosystems is the mosquito *Culex tarsalis* (Walker and Naugle 2011) and WNV persists through a mosquito-bird-mosquito infection cycle (McLean 2006), although bird-to-bird transmission has been observed (McLean 2006; Walker and Naugle 2011). Although mortality from WNV has been observed in Alberta (Naugle et al. 2004), cooler ambient temperatures in more northerly locations may reduce the exposure risk of Greater Sage-Grouse to WNV in Canada. In British Columbia, WNV surveillance between 2005 and 2014 in the Okanagan Valley detected the virus in 2009, 2010, 2011 and 2013 (BC Centre for Disease Control 2014) demonstrating the virus occurs within the former range.

Many small and medium-sized predator populations have increased over the past century with the removal of larger predators like Grey Wolves (*Canis lupus*) and Grizzly Bears (*Ursus arctos*), and expansion of trees and irrigated agriculture. Now Coyote (*Canis latrans*), Red Fox (*Vulpes vulpes*), Raccoon (*Procyon lotor*), Great-horned Owl (*Bubo virginianus*), Common Raven (*Corvus corax*) and American Crow (*Corvus brachyrhynchos*) are more abundant, and are known to be predators of Greater Sage-Grouse birds and eggs (Stinson et al. 2004; Environment Canada 2014). Conover and Roberts (2016) reviewed the evidence though, and suggest only Common Raven depredation of nests appears to be a range-wide threat.

5. Critical Habitat

Section 41(2) of SARA requires that if the recovery of a listed wildlife species is not feasible, the recovery strategy must include an identification of the species' critical habitat to the extent possible. Critical habitat identification for the Greater Sage-Grouse *phaios* is not possible at this time. The former distribution of the species in British Columbia prior to 1918 is not well-known, and habitat sufficient and suitable for management or restoration does not appear to be available to support the species. Critical habitat for the Greater Sage-Grouse *phaios* in Canada is therefore not identified in this federal recovery strategy.

6. Conservation Approach

Recovery of Greater Sage-Grouse *phaios* is not considered technically and biologically feasible at the present time. Although the Province of British Columbia, Nature Conservancy of Canada, and The Nature Trust of British Columbia have substantial land holdings protected for conservation surrounding Osoyoos and along the border with the U.S.A., there remain many limitations. It is highly unlikely that habitat in Canada was ever sufficient in area or suitable in quality to sustain a population independently of a contiguous population in Washington State. More valley-bottom moist meadow habitat cannot feasibly be restored to support brood-rearing habitat. Translocation of 3200 birds into southern British Columbia and along a 100 km length of the Okanagan valley in northern Washington State to create a self-sustaining population is not part of the on-going U.S. Sage Grouse Initiative (NRCS 2015) nor the comprehensive conservation plan (Stinson et al. 2006). While translocations of Greater Sage-Grouse to supplement existing populations has met limited success (Baxter et al. 2008), translocation efforts for reintroduction of extirpated populations are most often met with failure (Schroeder and Vander Haegen 2011). Recovery of the species may become biologically and technically feasible if relict populations are discovered in Canada, and/or if translocation from viable populations in the United States becomes feasible and appropriate.

Any discovered or reintroduced Greater Sage-Grouse *phaios* populations in Canada would face several threats and limiting factors, as outlined previously in this document. Anthropogenic threats would need to be identified and addressed in survival and

recovery habitats through habitat protection, restoration, and management; and continued management intervention would likely be required over the long term.

7. Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)⁹. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy](#)'s¹⁰ (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

The historic range of Greater Sage-Grouse *phaeos* overlaps with that of several other rare species occurring in similar habitats of the south Okanagan valley in British Columbia, such as: American Badger (*Taxidea taxus jeffersonii*), Behr's Hairstreak (*Satyrium behrii*), Burrowing Owl (*Athene cunicularia*), Common Nighthawk (*Chordeiles minor*), Desert Nightsnake (*Hypsiglena chlorophaea*), Grand Coulee Owl-clover (*Orthocarpus barbatus*), Great Basin Gophersnake (*Pituophis catenifer deserticola*), Great Basin Spadefoot (*Spea intermontana*), Half-moon Hairstreak (*Satyrium semilunar*), Lyall's Mariposa Lily (*Calochortus lyallii*), Mormon Metalmark (*Apodemia mormo*), Northern Rubber Boa (*Charina bottae*), Nuttall's Cottontail (*Sylvilagus nuttallii nuttallii*), Okanagan Efferia (*Efferia okanagana*), Sage Thrasher (*Oreoscoptes montanus*), Western Harvest Mouse (*Reithrodontomys megalotis megalotis*), Western Rattlesnake (*Crotalus oreganus*), Western Skink (*Plestiodon skiltonianus*), Western Tiger Salamander (*Ambystoma mavortium*), Western Toad (*Anaxyrus boreas*), Western Yellow-bellied Racer (*Coluber constrictor mormon*), and Yellow-breasted Chat (*Icteria virens*). If a relictual population of Greater Sage-Grouse *phaeos* is discovered and/or if reintroduction of the species is considered, recovery planning impacts on non-target recovery species in British Columbia will need to be taken into account. Any recovery planning activities for the Greater Sage-Grouse *phaeos* will be implemented with consideration of all co-occurring species at risk, to avoid or minimize negative impacts to these species and their habitats.

⁹ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

¹⁰ <http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1>

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